

**UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA**

UNIVERSITY OF BRITISH COLUMBIA,

Plaintiff/Counterclaim-
Defendant,

v.

CAPTION HEALTH, INC.
GE HEALTHCARE TECHNOLOGIES,
INC.,

Defendants.

Case No. 3:24-cv-3200-EKL

**DEFENDANTS' FIRST AMENDED
INVALIDITY CONTENTIONS**

Judge: Eumi K. Lee

Defendants/Counterclaim-Plaintiffs, Caption Health, Inc. and GE HealthCare Technologies, Inc. (collectively, "Defendants"), disclose these Amended Invalidity Contentions pursuant to Northern District of California Patent L.R. 3-3 and the Court's Scheduling Order (ECF No. 82). These Amended Invalidity Contentions are responsive to: Plaintiff's Initial Disclosure of Asserted Claims and Preliminary Infringement Contentions, and Exhibits A and B attached thereto, served on October 23, 2024 ("Initial Infringement Contentions"); Plaintiff's First Supplemental Disclosure of Asserted Claims and Preliminary Infringement Contentions, and Exhibits A and B attached thereto, served on November 22, 2024 ("First Supplemental Infringement Contentions"); Plaintiff's Second Supplemental Disclosure of Asserted Claims and Preliminary Infringement Contentions, and Exhibits A, B, C, and D attached thereto, served on February 7, 2025 ("Second Supplemental Infringement Contentions"); and Plaintiff's Third Supplemental Disclosure of Asserted Claims and Preliminary Infringement Contentions, and Exhibits E and F attached thereto, served on July 9, 2025 ("Third Supplemental Infringement Contentions") (collectively, "Plaintiff's Infringement Contentions").

These Amended Invalidity Contentions are based on information currently available to

Defendants and Defendants' current understanding of Plaintiff's interpretation of the asserted claims, as evidenced by Plaintiff's Infringement Contentions. Defendants' Amended Invalidity Contentions should not be interpreted as an admission regarding the meaning or scope of any asserted claim. Defendants believe that the asserted claims, when properly construed, do not cover Defendants' accused products. Nevertheless, where Plaintiff has asserted that particular claims are broad enough to read on Defendants' products, Defendants have identified prior art that would invalidate the claims if Plaintiff's interpretation is adopted. Where possible, Defendants have provided alternative grounds for invalidity based on a range of possible claim interpretations, including interpretations with which Defendants do not necessarily agree.

These Amended Invalidity Contentions are provided before Defendants have completed their investigation of the facts, before discovery is completed, and without the benefit of the Court's claim construction. Because Defendants' investigation is ongoing, including their search of the prior art, these contentions are not final, and this disclosure is made without prejudice to Defendants' rights to rely on or produce evidence of additional prior art references. Defendants reserve the right to supplement, amend, or revise these contentions based on: (i) new or different infringement allegations by Plaintiff; (ii) newly discovered prior art; (iii) claim interpretations expressly urged by Plaintiff or adopted by the Court; or (iv) arguments offered by Plaintiff in response to these Amended Invalidity Contentions, including arguments disputing that any identified prior art reference discloses one or more elements of the asserted claims. To the extent that Defendants are required to seek leave of court for such an amendment, Defendants reserve the right to do so.

I. GROUNDS FOR INVALIDITY UNDER 35 U.S.C. §§ 102 AND 103

Pursuant to Northern District of California Patent L.R. 3-3(a)-(c), Defendants contend that

claims 1–20 of U.S. Patent No. 11,129,591 (“the ’591 patent”) and claims 1–30 of U.S. Patent No. 10,751,029 (“the ’029 patent”) are invalid under 35 U.S.C. §§ 102 and/or 103 as set forth herein and the attached supporting claim charts. Defendants also incorporate herein, by reference, their Petitions for *Inter Partes* Review of the ’591 and ’029 Patents (IPR2025-01066 and IPR2025-01422, respectively), which detail multiple invalidity grounds for the same claims. To the extent any element of any asserted claim is not expressly described in the prior art references addressed in these Amended Invalidity Contentions, such element is nevertheless inherent or rendered obvious by the teachings of the identified prior art. To support these invalidity contentions, Defendants reserve the right to rely on expert testimony regarding the knowledge of a person of ordinary skill in the art (“POSITA”) at the time of the asserted patents, and/or background knowledge disclosed by or referred to in the asserted patents or any of the prior art patents identified herein.

A. The ’591 Patent

Claims 1–5, 7–9, 11–13 and 15–19 of the ’591 patent are rendered obvious under 35 U.S.C. § 103, by United States Patent Application Publication US2005/0251013 (“Krishnan”), which published Nov. 10, 2005. Krishnan is directed to systems and methods for automatically identifying the view category of an echocardiographic image and, based on the view category, automatically assessing the diagnostic quality of the image. Referring to Figure 1 below, Krishnan discloses a computer-implemented system 100 that includes a processor 101, a database 106 of medical images, and a machine learning classification module 108. The processor includes an image feature extraction module 102, an anatomy identification module 103, a view identification module 104, and an image quality assessment module 105. The classification module 108 includes a learning engine 109 and a set of trained classifiers 110 that are used by the various modules 102–

105 to perform their respective functions.

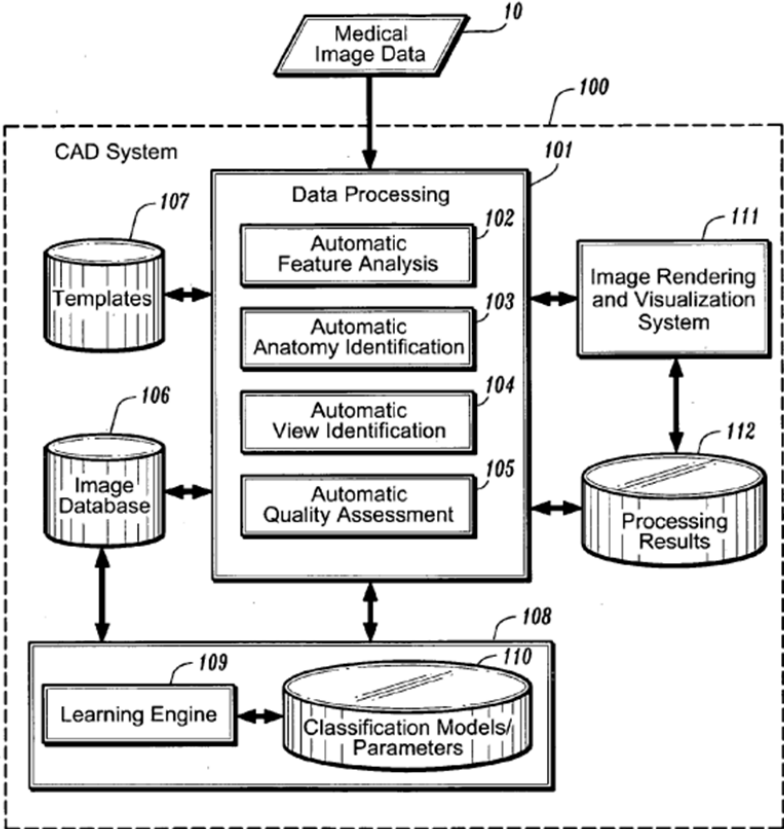


FIG. 1

The system 100 performs the method depicted in Figure 2, below, including the steps of: (i) obtaining an image dataset comprising one or more medical images; (ii) extracting relevant feature data from the image data set using known segmentation and/or filtering methods; (iii) using the extracted features to automatically identify the anatomy, view and/or quality of the image(s); and (iv) labeling the image(s) according to the anatomy, view, and quality assessment results. Specifically, the view identification module 104 and the quality assessment module 105 use the features extracted from an image as input to automatically identify the view of the acquired image and assess its quality. Krishnan also teaches that the results of view identification can be used for quality assessment.

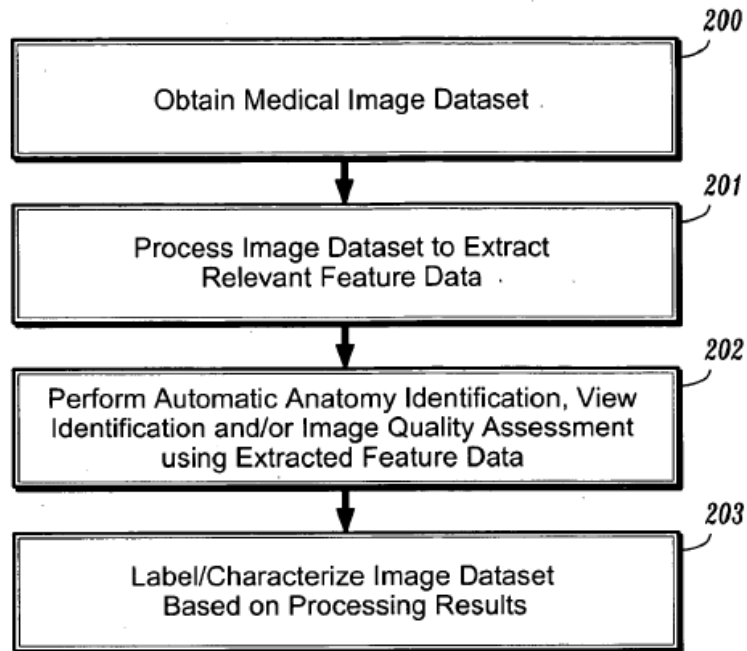


FIG. 2

In some embodiments, Krishnan uses multiple view-specific templates to assess the quality of echocardiographic images in different view categories. In other embodiments, Krishnan uses a bank of machine learning classifiers, including neural networks, to assess the quality of echocardiographic images in different view categories. In view of these teachings, Krishnan suggests and renders obvious the use of multiple view-category-specific neural network classifiers to evaluate the quality of images in different view categories. Moreover, this concept would be obvious to a POSITA in view of Krishnan's teachings since, as a practical matter, it would be simpler, more efficient, and more accurate to train multiple view-specific quality assessment neural networks than it would be to train a single neural network to assess the quality of echocardiographic images in all view categories.

To the extent Krishnan does not expressly describe one or more elements of the claims, Krishnan renders those elements obvious based on the general knowledge of a POSITA, including

general knowledge regarding common neural network structures and neural network training methods.

Claims 1–5, 7–9, 11–13 and 15–19 of the '591 patent are also invalid as obvious under 35 U.S.C. § 103 based on Krishan in view of United States Patent Application Publication US2016/0247034 (“Lee”), which published August 25, 2016, and was filed February 22, 2016. As discussed above, Krishnan describes determining echocardiographic image quality assessment values using view-category-specific templates or a bank of neural network classifiers. Lee describes determining image quality assessment values using view-category-specific assessment parameters. Specifically, after first classifying an image as belonging to a particular category, Lee then determines which of a plurality of stored classifiers corresponds to that category and determines an image quality score using that classifier. Thus, Lee expressly teaches the selection of a view-category-specific image quality classifier from a plurality of classifiers based on the determined view category.

A POSITA would understand from these combined disclosures that Krishnan’s “bank of classifiers” could be a plurality of view-category-specific quality assessment classifiers as taught by Lee. Additionally, these view-category-specific classifiers could each be neural networks instead of view-category-specific templates, as described in Krishnan. A POSITA would also understand that each of these “view-category-specific” classifiers would have different assessment parameters for evaluating the quality of images in different view categories. Indeed, it is common sense that because the various standard echocardiographic views depict different anatomical structures from different angles, the quality of images associated with respective views should be evaluated differently. Accordingly, the combined disclosures of Krishnan and Lee teach or suggest a plurality of view quality assessment neural networks, each associated with a respective

echocardiographic image view category, each having respective assessment parameters, and each configured to output a view-category-specific quality assessment value of one or more received images.

Moreover, it would have been obvious to a POSITA to combine the teachings of Krishnan and Lee as described above based on the express teachings and motivations supplied by the references themselves. Lee is analogous art to Krishnan. Both references are directed to the automatic assessment of the quality of images in different view categories using machine learning. And both references apply to medical imaging devices, including ultrasound machines.

Krishnan explains that echocardiographic images are categorized according to standard views and states that the identification of these views can be used to assess the quality of the echocardiographic images. Indeed, Krishnan describes template-based embodiments in which the quality of an image is determined by comparing its contents to the contents of view-category-specific templates. Krishnan also states, however, that “classifiers” can be used to assess the quality of images, and that these classifiers can be implemented using machine learning methods, model-based methods, or any combination of machine learning and model-based methods, including neural networks.

Lee expressly teaches that the quality of images in different categories should be assessed using different assessment parameters. Accordingly, Lee describes selecting an appropriate classifier for evaluating an image after first determining the category of the image. When this teaching is applied to Krishnan—particularly the embodiment in which Krishnan’s quality assessment classifier is based on a neural network—a POSITA would have been motivated to use respective view-specific neural networks to assess the quality of echocardiographic images in the respective view categories.

Claims 1–5, 7–9, 11–13, and 15–19 of the '591 patent are also invalid as obvious under 35 U.S.C. § 103 based on Krishan in view of United States Patent Application Publication US2017/0262982 (“Pagoulatos”), which published September 14, 2017, and has an effective filing date of March 9, 2016. Krishnan, as discussed above, uses a set of classifiers, including one or more neural networks, to assess the image quality of echocardiographic images. Pagoulatos is in the same field, i.e., using trained neural networks to evaluate echocardiographic images.

Pagoulatos describes an ultrasound image recognition module that can implement view-category-specific assessment parameters through a neural network like the one depicted below.

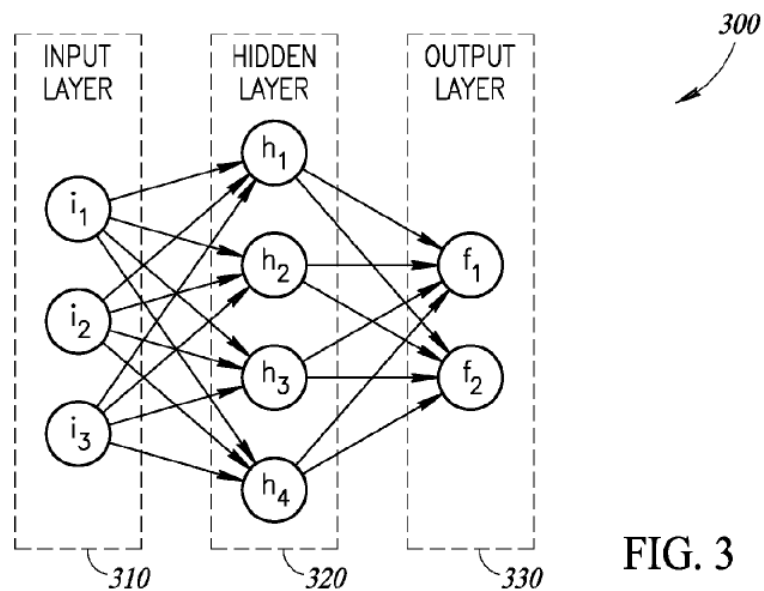


FIG. 3

Pagoulatos explains that this network, once sufficiently trained, can use view-category-specific knowledge/parameters to make determinations about whether acquired ultrasound images represent a clinically desirable view of one or more organs. For example, Pagoulatos states that a user may select a desired view of an organ that is to be imaged (e.g., a subcostal view of a heart), and the selected view may be communicated to the image recognition module so that the

ultrasound image recognition module may access the appropriate ultrasound image knowledge (e.g., knowledge, rules or regulations associated with a subcostal view of the heart) in the image knowledge database such that received ultrasound images may be compared with, or processed by, knowledge corresponding to the selected view.

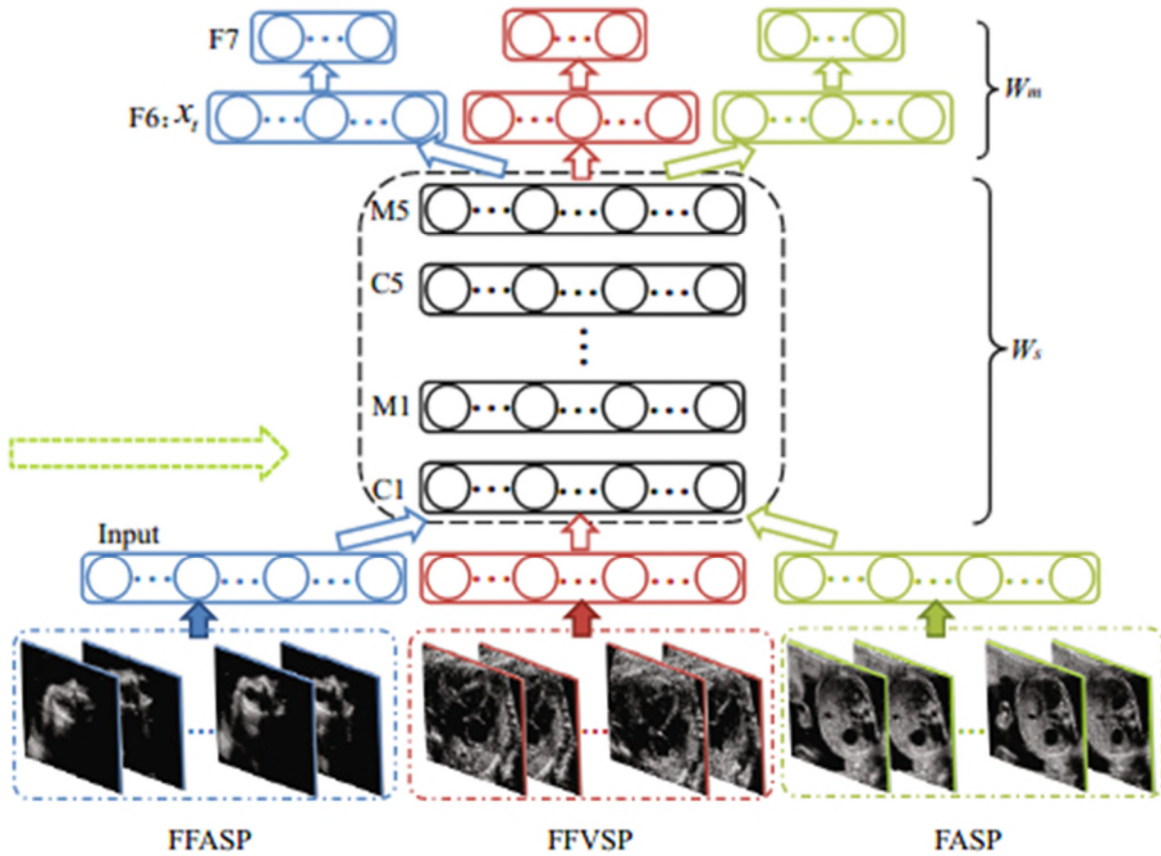
It would have been obvious to a POSITA to combine the teachings of Pagoulatos with Krishnan based on the express teachings and motivations supplied in both references. Each is directed to evaluating view-category-specific echocardiographic images using machine learning, including trained neural networks. Whereas Krishnan already describes using a set or bank of classifiers, and states that the results of view identification can be used for image quality assessment, Pagoulatos makes explicit that different view-category-specific assessment parameters can be accessed and used for image evaluation after the view category of an image is first identified. Moreover, whereas Krishnan states that its machine learning classifiers must be trained to perform their respective functions, Pagoulatos supplies detailed explanations of such training methods. Accordingly, a POSITA would have been motivated to combine the teachings of Krishnan and Pagoulatos.

Claims 6 of 20 of the '591 patent are rendered obvious under 35 U.S.C. § 103 by any of Krishnan, Krishnan in view of Lee, or Krishnan in view of Pagoulatos, each in further view of Chen et al., “Automatic Fetal Ultrasound Standard Plan Detection Using Knowledge Transferred Recurrent Neural Networks,” which is a conference paper from the 18th International Conference on Medical Image Computing and Computer-Assisted Intervention published by Springer International Publishing on November 18, 2015, in Medical Image Computing and Computer-Assisted Intervention, MICCAI 2015, Volume 9349, pp.507–514 (“Chen”).

Krishnan describes using neural network classifiers to automatically determine the view

category and quality of echocardiographic images. The architecture of such neural networks is a matter of design choice and is not limited by Krishnan. Relatedly, Chen describes methods for automatically detecting standard fetal ultrasound views using trained neural networks. Additionally, Chen states that the general framework of its teachings “can be easily extended to other US [ultrasound] standard plane or anatomical structure detection problems,” which would include detection of standard echocardiographic views.

Pertinent to claims 6 and 20 of the '591 patent, Chen teaches the advantages of using convolutional neural network (“CNN”) classifiers trained by joint learning across multiple tasks. Whereas conventional training of a CNN to perform a task requires large datasets of labeled training images, Chen explains that knowledge learned from training a CNN to perform one task could benefit the training for another task when limited training data is available. Accordingly, Chen proposes a joint learning model that produces neural networks with common shared layers and task specific layers, as depicted in the figure below.



Chen explains that the neural network layers identified as matrix W_s are trained using all training images from three separate tasks, e.g., identification of three different fetal structures. By contrast, the network layers identified as W_m denote view-specific layers trained individually on each task for the identification of different standard planes. Thus, Chen discloses a multi-stream CNN that contains shared layers with common assessment parameters and view-specific layers that were individually trained and contain unique, view-specific assessment parameters.

A POSITA would have been motivated to improve Krishnan, or Krishnan in view of Lee or Pagoulatos, based on the express teachings and suggestions in Chen. Whereas Krishnan, Lee, and Pagoulatos teach, suggest, and render obvious the use of multiple view-category-specific neural network classifiers having different assessment parameters for each view-category, Chen

teaches the advantages of combining such separate neural networks into a neural network having common layers and separate task-specific layers. Specifically, Chen teaches that by combining separate task-specific neural networks in a manner that they share some commonly trained layers, the problems of insufficient training data and overfitting can be reduced. To achieve the benefits explicitly described in Chen, a POSITA would have been motivated to structure the separate view-category-specific classifiers taught by Krishnan, Lee, and Pagoulatos to have both common and view-specific layers (i.e., common and view-specific assessment parameters).

Claims 7–9 and 11–13 of the '591 patent are also rendered obvious under 35 U.S.C. § 103 by Krishnan in view of Lee and in further view of Pagoulatos. Although Krishnan generally describes using a learning engine and previously diagnosed cases to train a set of machine learning classifiers for view identification and image quality assessment, Krishnan does not explicitly explain the training process – a detail that was apparently considered unnecessary for a POSITA who would presumably already be familiar with standard techniques for supervised machine learning. Pagoulatos, which is in the same field as Krishnan (i.e., analyzing the view category and quality of ultrasound images using neural networks), provides a more detailed explanation of the neural network training process. For example, Pagoulatos explains that neural networks may be trained by providing training images to the input layer of the network, where the training images may include known information (i.e., labels or annotations) such as various views, various image qualities or characteristics, various imaging angles, and so on. Through training, the weighted connections of the hidden layers of the neural network are modified to minimize the error between the predictions provided at the output layer of the network and the known information provided with the training images at the input layer. Thus, once the neural network has been sufficiently trained, it can receive non-training images at the input layer and make determinations at the output

layer about the view and quality of the received images.

Applying the neural network training technique described in Pagoulatos to the neural network classifiers disclosed in Krishnan would have been obvious to a POSITA because it would have merely amounted to applying a known technique to a known device to yield predictable results. Indeed, Pagoulatos explicitly describes its training technique as a common method of training artificial neural networks.

Claims 10 and 14 of the '591 patent are rendered invalid under 35 U.S.C. § 103 by any of Krishnan, Krishnan in view of Lee, Krishnan in view of Pagoulatos, or Krishnan in view of Lee and Pagoulatos, each in further view of Chen. Claims 10 and 14 depend from claim 7 and 11, respectively, both of which are invalid over Krishnan or Krishnan in view of Lee and/or Pagoulatos, as explained above. Claims 10 and 14 each add that the claimed sets of neural network parameters include a set of common neural network parameters, which are common to each of the sets, and a set of view category specific neural network parameters. These features are disclosed in Chen, as discussed above with respect to claims 6 and 20. Additionally, it would have been obvious to combine the teachings of Chen with the teachings of Krishnan for the same reasons already explained above with respect to claims 6 and 20.

Claims 1–5 and 15–19 of the '591 patent are also rendered obvious under 35 U.S.C. § 103, by International Patent Application Publication WO2016/189313 (“Paterson”), which published December 1, 2016, and has an effective filing date of May 28, 2015. Paterson is directed to systems and methods for automatically providing feedback during an imaging procedure, including automatically identifying the view category of an echocardiographic image and, based on the view category, automatically assessing the quality of the image. Although Paterson does not explicitly describe using neural networks to assess the quality of echocardiographic images, it would have

been obvious to a POSITA to implement Paterson using neural networks for image quality assessment based on the other teachings in Paterson. Not only does Paterson generally teach that its image assessment component may use standard object recognition techniques, it also specifically discloses the use of other machine learning algorithms such as, for example, cascaded, boosted object detectors. In view of these teachings, a POSITA would have understood that “standard object recognition techniques” would include the use of trained neural networks.

Claims 1–5, 7–9, 11–13, and 15–19 of the ’591 patent are also invalid as obvious under 35 U.S.C. § 103 based on Paterson in view of either Krishnan or Pagoulatos. Paterson discloses or renders obvious every element of claims 1–5 and 15–19. However, to the extent Paterson does not expressly describe the use of neural networks for image quality assessment, Krishnan and Pagoulatos both independently teach this feature. Additionally, Krishnan renders obvious, and Pagoulatos discloses, the neural network training features recited in claims 7–9 and 11–13.

It would have been obvious to a POSITA to implement the teachings of Paterson using neural network classifiers as described in Krishnan or Pagoulatos because each is directed to evaluating the quality of echocardiographic images and Paterson expressly states that its image quality assessment component can use standard object recognition techniques. A POSITA would know that neural networks, including convolutional neural networks, are a standard tool for recognizing objects in medical images. Accordingly, with the advent of improved neural network tools for assessing medical images, the improvement of Paterson using the teachings in Krishnan and Pagoulatos would be a natural and obvious progression based on Paterson’s own teachings.

B. The ’029 Patent

Claims 1–3, 9, 11, 21–22, 27, and 29–30 of the ’029 patent are anticipated under 35 U.S.C. § 102 by Krishnan. Alternatively, Krishnan renders the same claims obvious under 35 U.S.C.

§ 103.

Claims 1–4, 9, 11, 21–24, and 27–30 of the '029 patent are anticipated under 35 U.S.C. § 102, or rendered obvious under 35 U.S.C. § 103, by United States Patent Application Publication US2019/0076127 (“Aase”), which was filed Sept. 12, 2017.

Claims 1–2, 21–22, and 30 of the '029 patent are anticipated under 35 U.S.C. § 102, or rendered obvious under 35 U.S.C. § 103, by U.S. Patent No. 10,799,219 (“Specht”), which was filed Apr. 28, 2017.

Claims 1–3, 21–24, and 30 of the '029 patent are anticipated under 35 U.S.C. § 102, or rendered obvious under 35 U.S.C. § 103, by International Patent Application Publication No. WO2016/189313 (“Paterson”), which was filed May 26, 2016, and published December 1, 2016.

Claims 1–4, 6–16, 18–24, and 26–30 of the '029 patent are anticipated under 35 U.S.C. § 102, or rendered obvious under 35 U.S.C. § 103, by United States Patent Application Publication US2021/0177374 (“Balicki”), which claims an effective filing date of August 23, 2018.

Claims 9–10 and 27–28 of the '029 patent are rendered obvious under 35 U.S.C. § 103 by Krishnan in view of Aase. Claims 10 and 28 depend from claims 9 and 27, respectively, which in turn depend from claims 2 and 22, respectively, both of which are anticipated by Krishnan. Aase discloses all the additional limitations of claims 9, 10, 27, and 28, and it would have been obvious to a POSITA to combine Aase with Krishnan, or modify Krishnan based on Aase, to produce the claimed inventions.

Krishnan and Aase are in the same field. Both are directed to systems and methods for evaluating ultrasound images to automatically determine view category and image quality using machine learning techniques. Krishnan teaches a set or bank of machine learning neural network classifiers for performing quality assessment and view identification using extracted image

features as input. A view identification module uses the extracted features/parameters to automatically identify the view of an acquired image. A quality assessment module uses the extracted features/parameters to assess a level of diagnostic quality of an acquired image data set.

Like Krishnan, Aase is directed to a system and method for analyzing sets of ultrasound images of the heart (“loops”) to automatically assign an image view type and a quality assessment value. First, an image intake module separates a continuously captured stream of ultrasound image data into image loops. Then, an image loop view assignment module automatically assigns an image view type while an image characteristic metric assignment module assigns a quality assessment value to each image loop. Both the image loop view assignment module and the image characteristic metric assignment module may include one or more deep neural networks. Thus, Aase expressly describes evaluating ultrasound images using a view assignment neural network and a separate image quality metric neural network.

The rationale to implement Krishnan using a view-category-specific neural network and a quality-assessment-specific neural network, as in Aase, is supplied by the express teachings of the references themselves. Krishnan already describes a bank or set of classifiers that perform a variety of functions, including view identification and quality assessment. Krishnan also teaches that the various classifiers can be neural networks. Aase makes explicit what Krishnan already suggests, i.e., a quality-assessment-specific neural network can be used to assess quality, and a view-assignment-specific neural network can be used to identify the view category. Moreover, a POSITA would understand that training two separate neural networks to perform two distinct functions would be more efficient and more accurate than training a single neural network to perform multiple tasks simultaneously (i.e., identify view category and quality).

Claims 3–8 and 23–26 of the ‘029 patent are invalid as obvious under 35 U.S.C. § 103

based on Krishnan in view of either U.S. Patent No. 10,013,640 (“Angelova”), which was filed December 21, 2015, or Chen, which published in 2015.

Claims 3–8 all depend, ultimately, from claim 2, which is anticipated and/or rendered obvious by Krishnan. Claims 23–26 all depend, ultimately, from claim 22, which is also anticipated and/or rendered obvious by Krishnan. Chen and Angelova each disclose all the additional limitations of claims 3–8 and 23–26, and it would have been obvious to a POSITA to combine Krishnan with either of Chen or Angelova to arrive at the claimed inventions.

Krishnan, Chen, and Angelova are all analogous art that involve analyzing a series of images, such as short videos comprising a sequence of image frames. Krishnan, for example, describes processing loops of echocardiographic data and analyzing features across images, such as the motion of a particular point or the change of a particular feature across images. Krishnan explains, generally, that tasks such as image feature extraction, view identification, and image quality assessment can be performed using various machine learning classifiers, including neural networks. Chen and Angelova disclose particular neural networks designed to perform the same or similar tasks as those described in Krishnan. For example, Chen describes in detail recurrent neural networks (RNNs) for analyzing a sequence of ultrasound images to evaluate the image quality of key anatomical structures in the images and determine the view category of the images. Likewise, Angelova describes in detail multilayer RNNs for analyzing short sequences of images to perform classification tasks, such as object identification.

A POSITA would have been motivated to use neural networks like those disclosed in Chen and Angelova to perform the classification tasks described in Krishnan based on the teaching, suggestion, and motivation provided in the references themselves. For example, Chen teaches that its disclosed RNNs, which are based on spatio-temporal feature learning, are superior and perform

better in comparison to other methods. Chen describes the “high” demand for automatic detection methods in clinical practice and explains that its disclosed approach is a general framework that can be extended to the detection of other ultrasound standard planes or anatomical structures. Likewise, Angelova teaches that motion information extracted from video frames can be used as an additional cue for object recognition, and RNNs based on convolutional LSTM layers may be used to extract this motion information. Thus, a POSITA would have been motivated to use these RNNs as the neural network referenced in Krishnan.

Additionally, combining Krishnan with either Chen or Angelova would merely be: (i) combining prior art elements according to known methods to yield a predictable result; or (ii) applying a known technique to a known device/product ready for improvement to yield a predictable result. For example, Chen purports to be an improvement over earlier publications that describe detecting standard fetal views using only spatial features in individual ultrasound images. Specifically, Chen teaches the improvement of extracting features from consecutive frames of ultrasound videos and using recurrent neural networks to also consider temporal feature representations for the detection of standard views.

Krishnan, as already described, is capable of processing one or more ultrasound images, including loops of data (i.e., videos) to track the motion or change in a feature across images. A POSITA would have been motivated to improve Krishnan as described in Chen by leveraging the features extracted from consecutive image frames to obtain temporal information for better view identification.

Claims 12–20 of the ’029 patent are invalid as obvious under 35 U.S.C. § 103 based on Krishnan in view of Chen and in further view of “FUIQA: Fetal Ultrasound Image Quality Assessment With Deep Convolutional Networks” (“Wu”), which published in March 2017.

Krishnan discloses and teaches systems and methods to analyze sets of ultrasound images using machine learning, including neural networks, to extract features of the images and determine, based on those extracted features, the standard view category of the images and the quality of the images. Krishnan also describes and teaches the training of such neural networks using training images labelled according to their features/parameters. A POSITA would already be familiar with standard methods used to train neural networks, like those referenced in Krishnan. For example, a POSITA would understand that the typical method of training involves supplying the neural network with labelled training images as input and optimizing the network parameters (e.g., weights and biases) to output values that are as close as possible to the labels applied to the training images.

Since Krishnan discloses the use of neural network classifiers to determine the view category and image quality of ultrasound images, a POSITA would understand that those neural networks would be trained by supplying training images that are already labeled according to their view category and quality. Thus, a POSITA would understand that Krishnan teaches or suggests the method of training a neural network claimed in independent claim 12. Accordingly, Krishnan renders claim 12 obvious based on its own teachings and the knowledge of a POSITA. Alternatively, Chen and Wu disclose all the training elements recited in claim 12–20 and it would have been obvious to implement the teachings of Chen and Wu with Krishnan.

Krishnan, Chen, and Wu are all in the same field of automatic ultrasound image analysis using machine learning neural networks. Krishnan discloses and teaches the use of neural networks to determine the view category and image quality of ultrasound images. Chen teaches particular neural network architectures and training methods for evaluating the view category (i.e., standard plane) of ultrasound images, as described in Krishnan. Wu, building on the teachings of Chen,

further discloses particular neural network architectures and training methods for evaluating the quality of ultrasound images, as described in Krishnan. Thus, the references themselves supply the teaching, motivation, and suggestion to combine the neural networks and training methods described in Chen and Wu with Krishnan, which performs the same functions. Additionally, combining Krishnan with Chen and Wu would merely be: (i) combining prior art elements according to known methods to yield a predictable result; or (ii) applying a known technique to a known device/product ready for improvement to yield a predictable result. The neural network classifiers described in Krishnan need to be trained. Chen and Wu describe techniques for training such classifiers. Furthermore, both Chen and Wu expressly state that their teachings can be easily extended to other ultrasound views.

Claims 4–8 and 23–26 of the '029 patent are invalid as obvious under 35 U.S.C. § 103 based on Aase in combination with Angelova or Chen. Claims 4–8 all depend, ultimately, from claim 3, which is anticipated or rendered obvious by Aase. Claims 23–26 all depend, ultimately, from claim 22, which is also anticipated or rendered obvious by Aase. Both Angelova and Chen disclose all the additional limitations of claim 4–8 and 23–26, and it would have been obvious to a POSITA to combine either Angelova or Chen with Aase to produce the claimed inventions.

Aase, Angelova, and Chen are analogous art. Aase discloses and teaches systems and methods for evaluating short videos using one or more deep neural networks or any suitable form of deep learning. Aase leaves open the architecture or features of such neural networks. Angelova and Chen both describe, in detail, deep neural networks for performing the same function discussed in Aase – i.e., classifying short videos comprising a sequence of image frames. Thus, it would have been natural, and indeed a POSITA would have been motivated, to use the deep neural networks disclosed in Angelova or Chen to perform the functions described in Aase. The proposed

combination would merely be: (i) combining prior art elements according to known methods to yield a predictable result; or (ii) applying a known technique to a known device/product ready for improvement to yield a predictable result.

Claims 12–20 of the '029 patent are invalid as obvious under 35 U.S.C. § 103 based on Aase in combination with Chen and Wu. Aase discloses and teaches systems and methods to analyze sets of ultrasound images using one or more deep neural networks to determine the view category of the images and the quality of the images. Aase also describes, generally, a method and system for training such neural networks. Aase leaves open the architecture and features of such neural networks stating that any suitable form of machine learning processing functionality can be utilized. Chen teaches particular neural network architectures and training methods for evaluating the view category (i.e., standard plane) of ultrasound images, as described in Aase. Wu, building on the teachings of Chen, further discloses and teaches particular neural network architectures and training methods for evaluating the quality of ultrasound images, as described in Aase. Together, Aase in view of Chen and Wu teach all the limitations of claims 12–20.

It would have been obvious to a POSITA to combine Aase with Chen and Wu. Aase, Chen, and Wu are all analogous art. Each is directed to the evaluation of sets of ultrasound images using machine learning neural networks. Additionally, Aase discloses and teaches performing certain functions, such as view identification and image quality assessment, using neural networks – but without limitation to particular neural networks. Chen and Wu disclose neural networks for performing the same functions described in Aase and also describe methods for training those networks. Thus, the references themselves supply the teaching, motivation, and suggestion to combine the neural networks and training methods described in Chen and Wu with Aase. The proposed combination would merely be: (i) combining prior art elements according to known

methods to yield a predictable result; or (ii) applying a known technique to a known device/product ready for improvement to yield a predictable result.

C. Supporting Claim Charts

The claim charts attached hereto as Appendix A ('591 patent) and Appendix B ('029 patent) provide direct citations to the locations where each recited element of each asserted claim can be found in the prior art—either by express description, inherent disclosure, or general suggestion. Where Defendants have asserted, anywhere within these contentions or the supporting claim chart, that a prior art reference teaches a particular element of a claim, Defendants reserve the right to cite such reference as teaching such element in any other combination of prior art that would render the claim obvious. For the sake of clarity and brevity, Defendants have listed what they believe to be the most straightforward combinations of prior art references. To the extent that Plaintiff disputes the teachings of the prior art or the motivations to combine certain references, Defendants may provide additional or alternative combinations of the cited references that render the claims obvious. In this regard, Defendants further provide notice of United States Patent Application Publication US2012/0065510, which published March 15, 2012, and International Patent Application Publication WO2014/207642, which published on December 31, 2014 – both of which further evidence the state of the prior art before the filing date of the '591 patent. Defendants also provide notice of Cheng, “Transfer Learning with Convolutional Neural Networks for Classification of Abdominal Ultrasound Images,” *Journal of Digital Imaging* 30:234–243 (2017) (“Cheng”), which further evidences the state of the prior art before the filing date of the '029 patent.

Clear and logical rationales to combine any of the prior art references identified herein exist from the prior art references themselves, as well as from common sense and/or the

knowledge, talent, and ingenuity possessed by a POSITA. Examples of such rationales are clearly articulated above and in IPR2025-01066 and IPR2025-01422, both of which are incorporated herein by reference. Defendants believe no more specific showing of a motivation to combine prior art is required at this stage. If and to the extent Plaintiff challenges the motivation to combine any of the identified prior art references in the combinations identified here, Defendants reserve the right to supplement these contentions with expert testimony addressing the knowledge and skill of a POSITA and the motivation of a POSITA to make such combinations.

II. GROUNDS FOR INVALIDITY UNDER 35 U.S.C. §§ 101 AND 112

Pursuant to Northern District of California Patent L.R. 3-3(d), Defendants contend that asserted patent claims 1–6, 10, and 14–20 of the ’591 patent and claims 1–3, 11, 21–22, and 30 of the ’029 patent are invalid under 35 U.S.C. §§ 101 and/or 112.

Claims 1–6 and 15–20 of the ’591 patent are invalid under 35 U.S.C. § 101 because the claims are directed to an unpatentable abstract idea. Each of claims 1–6 and 15–20 merely claim the computer-implemented automation of functions previously performed by human physicians, namely receiving medical images, analyzing the quality of the images, and associating the images with the results of the image quality assessment. The recitation of generic neural networks to perform the same analysis previously performed by humans does not render the claims patentable.

Claims 6, 10, 14, and 20 are invalid under 35 U.S.C. § 112 because they are indefinite and/or not enabled by the specification and drawings of the ’591 patent. Each of claims 6, 10, 14, and 20, recite respective sets of view-category-specific neural network parameters that define respective view-category-specific neural networks. Each of claims 6, 10, 14, and 20 also recite “in response to determining that [a] first set of assessment parameters is associated with [a] first view category, inputting the first at least one echocardiographic image into the neural network defined

by the first set of assessment parameters,” where “each of the sets of assessment parameters includes: a set of common assessment parameters, which are common to each of the sets of assessment parameters; and a set of view category specific assessment parameters, which are unique to the set of assessment parameters.” With reference to Figure 8 and column 12, lines 7–41 of the ’591 patent, if the claimed “common assessment parameters, which are common to each of the sets of assessment parameters,” are construed to include shared layers of a “multi-stream” neural network, then the ’591 patent does not enable such a network. For example, the ’591 patent does not disclose how an echocardiographic image, once input into the common layers of such a network, is subsequently input into the appropriate view-category-specific layers of the network. Thus, the ’591 patent does not enable the claimed step of “inputting the first at least one echocardiographic image into the neural network defined by the first set of assessment parameters.”

Claims 1–3, 11, 21–22, and 30 of the ’029 patent are invalid under 35 U.S.C. § 101 because the claims are directed to an unpatentable abstract idea. Each claim merely recites the computer-implemented automation of mental processes previously performed by physicians, namely receiving medical images, analyzing the properties and quality of the images, and associating the images with the results of the image assessment. The claims are untethered to any particular implementation and could be performed as mental steps using a pencil and paper. The mere recitation of a generic processor to perform the same analysis previously performed by humans does not render the claims patentable.

Claim 30 of the ’029 patent is invalid under 35 U.S.C. § 112(f) because the claims do not include sufficient structure to perform the recited functions and the specification of the patent does sufficiently link corresponding structure or specific algorithms to the claim language for

performing the recited functions.

III. DOCUMENT PRODUCTION

Pursuant to Patent L.R. 3-4, Defendants are producing, or have already produced and made available for inspection, the following categories of documents:

(a) Source code, specifications, schematics, flow charts, artwork, formulas, or other documentation sufficient to show the operation of any aspects or elements of an Accused Instrumentality identified by UBC in its Patent L.R. 3-1(c) chart;

- See CAPTION00000001–CAPTION00000078 produced on November 22, 2024.
- See CAPTION00000452 produced on December 6, 2024.
- See CAPTION00001430–CAPTION00002879 produced on August 22, 2025.
- Pursuant to Section 9 of the parties’ Stipulated Protective Order (Dkt. 43), Defendants have made available for inspection the source code for the Accused Products.

(b) A copy or sample of the prior art identified pursuant to Patent L.R. 3-3(a) which does not appear in the file history of the patent(s) at issue;

- See CAPTION00000453–CAPTION00000462 and CAPTION00000539–CAPTION00000557 produced on December 6, 2024.
- See CAPTION00000744–CAPTION00000828 produced on April 18, 2025.

(c) All agreements that may be related to the accused instrumentality or may be comparable to a license that would result from a hypothetical reasonable royalty negotiation;

- See CAPTION00000079–CAPTION00000449 produced on December 6, 2024.

(d) Documents sufficient to show the sales, revenue, cost, and profits for accused instrumentalities identified pursuant to Patent L.R. 3-1(b) for any period of alleged infringement; and

- See CAPTION00000450–CAPTION00000451 produced on December 6, 2024.
- See CAPTION00002880 produced on August 22, 2025.

(e) All agreements that may be used to support Defendants' damages case.

- See CAPTION00000079–CAPTION00000449 produced on December 6, 2024.

Discovery is ongoing, and Defendants reserve the right to supplement this production as additional documents are identified, collected, and reviewed.

[Signatures on following page]

Respectfully submitted,

Dated: August 22, 2025

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CERTIFICATE OF SERVICE

I hereby certify that on August 22, 2025, a true and correct copy of the foregoing document was transmitted via electronic mail addressed to:

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/s/ Jesse Jenike-Godshalk

Jesse Jenike-Godshalk